

REMARKS

The allowance of claims 1-12 and 14-32 is acknowledged.

As previously pointed out in Amendment A, filed June 20, 2002, the term "offgas" in claim 13 is qualified by the immediately following phrase "from petroleum refining, gas liquefaction or rubber vulcanization operations." Accordingly, the Examiner's proposed amendment is inconsistent with the proper syntax of this claim. Allowance of claim 13 in its current form is again respectfully requested.

Reconsideration is respectfully requested of the rejections under 35 U.S.C. §103(a) of claims 33-39 based on U.S. Patent No. 4,088,743 (Hass et al.) in view of pages 17, 25 and 26 of Fuel Flue Gases: The Application and Interpretation of Gas Analysis and Tests, American Gas Association, edited by C. George Segeler (1940) ("Fuel Flue Gases") and the rejection of claims 33-42 based on Hass et al. and Fuel Flue Gases in further view of pages 18-84 to 18-90 in the Chemical Engineer's Handbook (Fifth Edition) by Perry et al.

Independent claim 33 is directed to a process for the production of elemental sulfur from an acid gas feed stream containing hydrogen sulfide and an unsaturated hydrocarbon component selected from the group consisting of linear olefins, branched olefins, aromatic hydrocarbons and mixtures thereof. The hydrogen sulfide is oxidized to elemental sulfur in a catalytic reaction zone containing an oxidation catalyst and supplied with an oxidant gas. The acid gas feed stream is pretreated upstream of the catalytic reaction zone to reduce the concentration of the unsaturated hydrocarbon component and inhibit deactivation of the catalyst by contacting at least a portion of the acid gas feed stream with an aqueous acid wash to react unsaturated hydrocarbons with the acid and form an addition reaction product and then separating the addition reaction product from the acid gas feed stream.

In order to establish a *prima facie* case of obviousness, the Patent Office must establish, among other things, that there is some suggestion or motivation, either in the references

themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. The Patent Office must also establish that the reference, or references when combined, teach or suggest all of the claim limitations. As detailed below, the cited references fail to establish a *prima facie* case of obviousness with respect to the rejected claims.

In the primary reference, Hass et al. disclose a process which includes the selective catalytic incineration of hydrogen sulfide (H_2S) in a feed gas with oxygen to produce sulfur dioxide (SO_2) in accordance with Reaction Equation (I) and carried out in a catalytic incinerator (11). In instances where the incoming feed gas contains more than about 400 ppmv of H_2S , Hass et al. teach that it may be desirable prior to selective catalytic incineration to catalytically oxidize a portion of the H_2S with oxygen directly to elemental sulfur in accordance with Reaction Equation (IV). This is achieved by directing all or a portion of the feed gas 1 in Fig. 1 to catalytic oxidation reactor (25) along with an oxygen-containing gas (See Example 1, line 51, et seq.).

Hass et al. discloses a variety of H_2S -containing feed gases, including discharge from petroleum refineries, sewage plants, meat packing plants, geothermal power plants, soap factories and chemical manufacturing plants as well as sour natural gases and sour refinery gases (See col. 2, lines 45-52). In Example XII, Hass et al. disclose "a specific embodiment of the invention" in which the H_2S in the vent gases emanating from geothermal power plants is incinerated in accordance with the disclosed invention. As shown in Fig. 2, **geothermal steam** is sent to a turbine (60) and the exhausted steam/ H_2S -containing vent gases are passed to a contact condenser (80) where the gases are condensed by contact with cooling water. The resulting liquid mixture (i.e., cooling water and steam condensate) is sent to a cooling tower (130) and recirculated to the condenser. A portion of the H_2S and other non-condensable components of the vent gases is withdrawn from the condenser and fed to the

disclosed process to effect ultimate catalytic incineration of the H₂S contained in these gases (See col. 15, line 55 to col. 16, line 40). Preferably, purified off-gases from catalytic incinerator (11) are sent via line (170) to a conventional SO₂ scrubber wherein SO₂ is dissolved in an aqueous solvent and the remaining purified gases are sent to the atmosphere. A preferred aqueous SO₂ absorbing medium is cooling water from cooling tower (130) and a portion of the resulting scrubber waste water is recirculated back to the cooling tower to maintain the cooling water in the desired pH of about 5.5-7.5. Rather than having any purpose with respect to removing unsaturated hydrocarbons from an H₂S-containing feed gas, the acidic scrubber waste water is said to counteract the tendency of ammonia **normally present in geothermal steam** to increase the pH of the cooling water to above 7.5 which may lead to scaling problems (See col. 16, lines 42-67).

At the top of page 4 of the Office action, contacting the H₂S-containing geothermal steam with cooling water mixed with SO₂ scrubber waste water in the contact condenser is equated with the acid gas pretreatment defined in claim 33. On page 5 of the Office action the Examiner asserts:

"[I]t would have been obvious to one of ordinary skill in the art at the time the invention was made to *modify* the process described in col. 15 lns. 55 et seq. and also fig. 2 in U.S. Pat. 4,088,743 by *substituting* one of the feed gases described in col. 2 lns. 45-61 in U.S. Pat. 4,088,743 *in lieu* of the geothermal steam expressly treated in the process described in col. 15 lns. 55 et seq. in U.S. Pat. 4,088,743, in the manner embraced in the scope of at least applicants' claims 33 and 39, because the disclosure set forth in col. 2 lns. 45-61 of U.S. Pat. 4,088,743 fairly suggests that the authors of this patent contemplated the treatment of these unsaturated hydrocarbon-containing feed gases mentioned in col. 2 lns. 45-61 of U.S. Pat. 4,088,743."

This reasoning underlying the rejection of claim 33 wholly misconstrues the teaching of Hass et al. in the embodiment shown in Fig. 2 and described in Example XII thereof. As would be understood by those skilled in the art, the disclosure in Fig. 2 and Example XII of contacting H₂S-containing **geothermal steam** exhausted from a power plant with cooling water in a contact

condenser is unique to processes in which the H₂S-containing feed gas comprises steam. This practice is to condense and remove the considerable water vapor load in exhausted geothermal steam and render more practical the subsequent catalytic incineration of the H₂S contained in the remaining non-condensable gases. By contrast, the pretreatment called for in claim 33 of contacting an acid gas feed stream with an acidic aqueous wash is to react unsaturated hydrocarbons with the acid and form an addition reaction product that can be separated from the acid gas feed stream. However, as acknowledged by the Examiner on page 4 of the Office action, unlike the acid gas feed stream called for in claim 33, geothermal steam does not contain unsaturated hydrocarbons (See for example, col. 15, lines 58-60; and col. 17, lines 47-55 of Hass et al.). Thus, despite the mention in the primary reference of a variety of other H₂S-containing feed gases, including sour natural gases and sour refinery gases, one skilled in the art would recognize that the process shown in Fig. 2 and described in Example XII as "a specific embodiment of the invention" is adapted to treatment of H₂S-containing geothermal steam wherein a contact condenser is used to reduce the water vapor load prior to the catalytic incineration treatment. There is no teaching in the primary reference (nor any conceivable practical reason for that matter) which would motivate one skilled in the art to use the process as shown in Fig. 2 to treat sour natural gases, sour refinery gases or any other H₂S-containing feed streams not in the form of steam. Rather, one skilled in the art would identify the process as shown in Fig. 1 of Hass et al., which does not include a steam condensing step, as being applicable to treat such other H₂S-containing feed streams. In Example I of Hass et al., the embodiment shown in Fig. 1 was used to treat a hydrogenated Claus tail gas.

Like the primary reference, neither Fuel Flue Gases nor the Chemical Engineer's Handbook teach or suggest pretreatment of an H₂S-containing acid gas feed stream to remove unsaturated hydrocarbons prior to catalytic oxidation of H₂S to elemental sulfur.

Accordingly, in view of the above, applicants respectfully submit that the references cited in the Office action fail to establish a *prima facie* case of obviousness with respect to the invention defined in independent claim 33. Dependent claims 32-43 which depend from claim 33 are likewise submitted as patentable over the cited art. Given the clear basis for patentability of the rejected claims, applicants defer comment at this time regarding other assertions made in the Office action, including the relevance of the disclosure in the Fuel Flue Gases reference, only limited portions of which were provided with the Office action, the acidity of the water contacted with the geothermal steam in Example XII of Hass et al., the assertions on page 5 of the Office action that the SO₂ scrubber waste water would inherently contain sulfuric acid and in the claimed concentrations as well as assertions regarding features recited in the other dependent claims.

Favorable reconsideration and allowance of all pending claims are respectfully solicited. In order expedite allowance of this application, the Examiner is invited to contact the undersigned attorney to discuss any remaining issues.

Applicants request an extension of time to and including August 6, 2003 for filing a response to the above-mentioned Office action. A check in payment of the applicable extension fee is enclosed.

The Commissioner is requested to charge any fee deficiency or overpayment in connection with this amendment to Deposit Account 19-1345.

Respectfully submitted,



Vincent M. Keil, Reg. No. 36,838
SENNIGER, POWERS, LEAVITT & ROEDEL
One Metropolitan Square, 16th Floor
St. Louis, Missouri 63102
(314) 231-5400

VMK/ACW/msc
*Enclosure

Express Mail Label No. EV 327052319 US